CMAQ and the New York Climate & Health Project

Investigators: Patrick L. Kinney*, Christopher Small*, William D. Solecki+, Roni Avissar°, Christian Hogrefe±, Michael Ku-, Kevin Civerolo-, Cynthia Rosenzweig§, David Werth°, Tracey Holloway*, Joyce E. Rosenthal*, Kim Knowlton*, Anjali Puri*
* Columbia University*
+ Montclair State University
° Duke University
± State University of NY at Albany
- NYS Dept. of Environmental Conservation
§ NASA Goddard Institute for Space Studies

Abstract:

The EPA Community Multi-Scale Air Quality Model (CMAQ) is being applied as a component in a multi-disciplinary/multi-model assessment of future health impacts in the New York metropolitan area due to changing climate and land use. Elevated concentrations of ozone and fine particles, current public health stressors in the New York region, may be impacted by future changes in the global climate and continued expansion of human-dominated land uses.

The study employs a system of linked models on a global to regional scale. CMAQ transport is driven by winds from a regional climate model, and these winds in turn are simulated using boundary conditions from a coarser-resolution global climate model. The modeling systems used are: the Goddard Institute for Space Studies (GISS) Global Atmosphere-Ocean Model; the Regional Atmospheric Modeling System (RAMS) and Penn State/NCAR MM5 mesoscale meteorological models; the SLEUTH land use model; the Sparse Matrix Operator Kernel Emissions Modeling System (SMOKE); and the Community Multi-scale Air Quality (CMAQ) and Comprehensive Air Quality Model with Extensions (CAMx) models for simulating regional air quality.

We aim to address how the frequency and severity of episodic concentrations of ozone (O_3) and fine particulate matter ($P_{M2.5}$) may change over the next 80 years under the A2 and B2 IPCC climate change scenarios, as well as a range of possible land use scenarios. Projected air pollutant concentrations will be used to inform a public health assessment for the NY area. Impacts will be examined during the decades of the 2020s, 2050s and 2080s. Predictions from both the meteorological models and the air quality models are compared against available observations for the simulations in the 1990s to establish baseline model performance. In addition to air quality impacts based on CMAQ simulations, we will examine health impacts from heat stress under the A2 and B2 scenarios.